

AMENDMENT

Serial Number: 10/786,379

Filing Date: February 25, 2004

Title: Method of Protecting Metals From Corrosion Using Thiol Compounds

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YOU102**REMARKS**

The Official Action mailed August 1, 2006 has been carefully considered. Claims 1-3, 5-14, and 17 are pending in the application and stand rejected. Claims 11 and 12 have been rejoined in the application. Claims 18-23 have been cancelled without prejudice and may be presented in a divisional application. Reconsideration and allowance of the subject application, as amended, are respectfully requested.

Claim Amendments

Claim 1 has been amended to recite: "drying or curing the treated metal, wherein a coating consisting essentially of said thiol compound is formed directly on the metal surface." Support for this amendment may be found in paragraph [0034] of the published application, which recites: "a coating solution comprising an alkanethiol dissolved in an organic solvent is applied to a metal surface." No new matter has been added by this amendment.

Claim 13 has been amended to recite: "drying or curing the treated galvanized steel, wherein a coating consisting essentially of said thiol compound is formed directly on said galvanized steel." Support for this amendment may be found in paragraph [0034] of the published application as recited above. No new matter has been added by this amendment.

35 USC §102 and 35 USC §103

Claims 1-3, 5-7, 9-11 and 13 stand rejected under 35 U.S.C. §102(b) as being anticipated by JP10-001786.

Claims 1 and 13 have been amended to recite that a coating consisting essentially of the thiol compound is formed directly on the metal surface or galvanized steel surface. JP10-001786 appears to disclose a zinc-group plated steel plate coated with a solution which contains silicic-acid ester and the mineral salt of aluminum forming a chemical-conversion-treatment film which comprises a mercaptide compound which is the reaction product of a thiol compound and a part of said chemical-conversion-treatment film on an upper surface layer. In addition, JP10-001786 describes that the chemical-conversion-treatment film may also include a thiol compound in addition to the mercaptide compound.

The Examiner correctly acknowledges that the “silicic acid ester is an undercoating, with the octadecanethiol a separate coating on top.” Accordingly, the reference does not anticipate the presently claimed invention, as the presently claimed subject matter requires that the thiol coating be applied directly to the metal surface.

In addition, according to the teachings of the ‘786 reference, the silicic acid ester is a required component that reacts with the thiol compound, such reaction therefore appears to change the nature of the thiol present in the coating. More specifically, the reference discloses that the thiol reacts with the silicic acid ester coating and forms mercaptide. See, e.g., Claim 1 of the ‘786 reference. Mercaptide is typically considered a compound of mercaptan formed by replacing its sulfur hydrogen by a metal, i.e., C_2H_5SM , wherein M is a metal. Accordingly, in view of the silicic acid ester undercoating and the reaction of the thiol with the silicic acid ester to form mercaptide, the reference does not appear to teach a coating which consists essentially of a thiol compound.

Furthermore, the presently claimed subject matter omits an element, which from reading the ‘786 reference, would otherwise appear necessary. That is, the ‘786 reference describes the silicic acid ester as providing the corrosion resistance, whereas the film including the mercaptide compound is disclosed as providing lubrication. In particular, the Applicants point to paragraph [0009] and [0013], which recite:

“[a]lthough the mechanism of the corrosion-resistant improvement by this chemical-conversion-treatment film is not necessarily clear, in hydrolysis/condensation process of silicic acid ester, a white-rust suppressibility is obtained by the siloxane bonding, furthermore, compaction of a film is increase by the aluminum in mineral salt, it is thought that corrosion resistance improves.”

“The film (lubrication layer) containing a mercaptide compound is formed in the upper layer of the above-mentioned Al-Si type chemical-conversion-treatment film. When the solution containing a thiol compound is applied to the above-mentioned Al-Si type chemical-conversion-treatment film surface, a thiol compound reacts with Al of an Al-Si type chemical-conversion-treatment film, or Al oxide, and forms a mercaptide compound, an Al-Si type chemical-conversion-treatment film surface will coat with a mercaptide compound. By letting such a mercaptide compound exist together on the Al-Si type chemical-conversion-treatment film surface, this inventor found out that the extremely excellent lubricating properties was obtained.”

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From the above, one might also note that the '786 reference therefore does not appear to provide an enabling disclosure of a coating consisting essentially of a thiol compound formed directly on a metal surface and/or fails to render the presently claimed subject matter as obvious. More specifically, with respect to the matter of enablement, §2121.01 of the MPEP provides that: "[t]he disclosure in an assertedly anticipating reference must provide an enabling disclosure of the desired subject matter." The '786 reference does not disclose that a coating consisting essentially of a thiol compound may be applied directly to a metal surface. Rather, the '786 reference only appears to disclose the combination of a thiol compound with an Al-Si type chemical-conversion-treatment film, wherein the thiol compound reacts with the conversion-treatment film to provide a mercaptide component to the coating.

Furthermore, with respect to obviousness, as noted above, the reference teaches the use of the chemical-conversion-treatment film to provide the corrosion-resistance, whereas the mercaptide film is taught to provide lubrication. Accordingly, one would not consider providing an unreacted thiol compound to produce corrosion resistance. Accordingly, the '786 reference does not anticipate or render obvious the presently claimed invention.

Claims 1-3, 7-8 and 10-11 stand rejected under 35 USC §102(b) as being anticipated by JP 57-198269.

Once again, the Examiner correctly recognizes that "'269 teaches coating by dipping (i.e. immersion for 2 seconds) a partially or wholly silver-plated stainless steel into a octadecylmercaptan solution (RN 2885-00-9) in ethanol or other organic solvents for corrosion protection. The solution is 0.01-5 weight %." (Emphasis added). As previously noted, the '269 reference, however, fails to teach or suggest that metals, other than a partially or wholly silver-plated stainless steel, may be utilized. See Amendment of February 1, 2007.

The Examiner's response to the above is "[i]t is not clear how this affects the rejection of claims 1-3, 7-8 and 10-11." Page 4 of the Office Action of May 1, 2007. As clarification is requested, the Applicants note the following: "[a] claim is anticipated if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art

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reference.” *Verdegaal Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987), see §2131 of the MPEP. As noted above, the ‘269 reference is directed solely to partially or wholly silver-plated stainless steel. Stainless steel, unlike other steel, includes relatively high amounts of chromium, at least 10 percent, with or without other elements. See attached photocopies from the “Machinery’s Handbook” pages 405. As presently claimed, the metal does not include a stainless steel and, therefore, the reference, disclosing only stainless steel, does not anticipate each and every element as set forth in the claim. Nor does the reference appear to render the claims obvious.

Claims 1-2 and 7-11 stand rejected under 35 USC §102(e) as being anticipated by Reihls et al, U.S. Patent No. 6,652,669.

U.S. 6,652,669 appears to be directed to a method for producing an ultraphobic surface on aluminum as support material. The reference discloses the use of the thiol coatings only with the use of adhesion promoters. More specifically, the disclosure states that “[p]referred adhesion promoters, e.g. for thiols as hydrophobic coating, are noble metal layers, e.g. of Au, Pt or Ag or those of GaAs, in particular of gold.” In addition, all of the examples refer to the use of n-decanethiol only on aluminum sheet which were coated with a gold layer by atomization. See Examples 1, 2, 5, 6, 7, 8, 9, 10 and 11. No where else does the reference appear to teach or suggest the use of thiol compounds. Therefore, it is respectfully asserted that the ‘669 reference provides an enabling disclosure only for those circumstances where thiols may be provided on a surface first coated with a noble metal.

Claims 1-3 and 7-11 stand rejected under 35 USC §102(b) as being anticipated by Ohno et al. In Ohno et al, the authors claim to demonstrate “the formation of nanostructural SAM of ODT using AlGaAs/GaAs hetero-epitaxial substrates.” Abstract. However, the abstract does not disclose that the formation of nanostructural SAM of ODT using the AlGaAs/GaAs hetero-epitaxial substrates was performed by dissolving or dispersing the thiol compound in a solvent and preparing a solution or dispersion, treating a metal with the solution or dispersion, and drying or curing the treated metal, wherein a coating consisting essentially of the thiol compound is

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formed directly on the metal surface. Accordingly, as Ohno et al do not disclose each and every element of the claim, Ohno does not anticipate the claimed subject matter.

In addition, the Examiner may appreciate that the AlGaAs/GaAs hetero-epitaxial substrates are semiconductor materials. From the limited disclosure presented to the Applicants, "AlGaAs/GaAs hetero-epitaxial substrates" appear to describe a crystalline gallium arsenide substrate having a crystalline film of aluminum gallium arsenide grown thereon. Accordingly, it is respectfully submitted that the above would therefore also fail to render the claimed subject matter as obvious as the SAM of ODT was being formed on a semiconductor rather than a metal selected from the group consisting of hot rolled steel sheet, cold-rolled steel sheet, hot-dipped metallic coated steel sheets, electroplated metallic coated steel sheets, aluminum sheets, aluminum alloy sheets, zinc sheets, and zinc alloy sheets.

Claims 1-3 and 7-11 stand rejected under 35 USC §102(b) as being anticipated by Ruan et al. Ruan et al is discloses: "[s]elf assembled monolayers (SAMS) of straight-chain alkylthiols and alkylamines ($C_nH_{2n+1}SH/NH_2$; $n=10, 12, 16$ and 18) are adsorbed from solution onto the electrochemically reduced (oxide free) surface of 216L stainless steel." Abstract.

While the article discusses that thiol anchored coatings have been reported on iron and metals, the article fails to disclose the above claimed methods. In particular, the article fails to disclose dissolving or dispersing said thiol compound in a solvent and preparing a solution or dispersion, treating the metal or galvanized steel with said solution or dispersion, and drying or curing the treated metal, wherein a coating consisting essentially of said thiol compound is formed directly on the metal surface or galvanized steel surface. In addition, the Applicants also note the discussion above with respect to the differences between stainless steel and metals selected from the group of hot rolled steel sheet, cold-rolled steel sheet, aluminum sheets, aluminum alloy sheets, zinc sheets, and zinc alloy sheets. Accordingly, Ruan fails to disclose each and every element of the claim and therefore does not anticipate the claimed subject matter.

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Claims 12 and 14 stand rejected under 35 USC §103 as being unpatentable over 10-001789. However, as claims 12 and 14 depend from and incorporate the limitations of independent claims 1 and 13, it is respectfully submitted that the claims define over the cited art.

Claims 9 and 12 stand rejected under 35 USC §103(a) as being unpatentable over JP 57-198269. However, as claims 9 and 12 depend from and incorporate the limitations of independent claim 1, it is respectfully submitted that the claims define over the cited art.

Claims 3 and 12 stand rejected under 35 USC §103(a) as being unpatentable over Reihs et al, U.S. Patent No. 6,652,669. However, as claims 3 and 12 depend from and incorporate the limitations of independent claim 1, it is respectfully submitted that the claims define over the cited art.

Claim 12 stands rejected under 35 USC §103(a) as being unpatentable over Ohno. However, as claim 12 depends from and incorporates the limitations of independent claim 1, it is respectfully submitted that the claim defines over the cited art.

Claim 12 stands rejected under 35 USC §103(a) as being unpatentable over Ruan et al. However, as claim 12 depends from and incorporates the limitations of independent claim 1, it is respectfully submitted that the claim defines over the cited art.

Having dealt with all the objections raised by the Examiner, it is respectfully submitted that the present application, as amended, is in condition for allowance. Early allowance is earnestly solicited. If the Examiner desires personal contact for further disposition of this case, the Examiner is invited to call the undersigned Attorney at 603.668.6560.

In the event there are any fees due, please charge them to our Deposit Account No. 50-2121.

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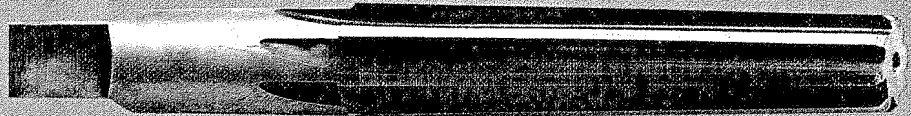
Respectfully submitted,

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Machinery's Handbook 25

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1996
INDUSTRIAL PRESS INC.
NEW YORK

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Library of Congress Cataloging-in-Publication Data

Oberg, Erik, 1881-1951

Machinery's handbook.

2560 p.

Includes index.

I. Mechanical engineering—Handbook, manuals, etc.

Jones, Franklin Day, 1879-1967

II. Horton, Holbrook Lynedon, 1907-

III. Ryffel, Henry H. 1920- IV. Title.

TJ151.0245 1996 621.8'0212 72-622276

ISBN 0-8311-2424-5 (Thumb Indexed 11.7 × 17.8 cm)

ISBN 0-8311-2595-0 (Thumb Indexed 17.8 × 25.4 cm)

LC card number 72-622276

INDUSTRIAL PRESS

200 Madison Avenue

New York, New York 10016-4078

MACHINERY'S HANDBOOK

25th Edition

Third Printing

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Alloy Steels: Alloy steels comprise not only those grades that exceed the element content limits for carbon steel, but also any grade to which different elements than used for carbon steel are added, within specific ranges or specific minimums, to enhance mechanical properties, fabricating characteristics, or any other attribute of the steel. By this definition, alloy steels encompass all steels other than carbon steels; however, by convention, steels containing over 3.99 per cent chromium are considered "special types" of alloy steel, which include the stainless steels and many of the tool steels.

In a technical sense the term alloy steel is reserved for those steels that contain a modest amount of alloying elements (about 1-4 per cent) and generally depend on thermal treatments to develop specific mechanical properties. Alloy steels are always killed, but special deoxidation or melting practices, including vacuum, may be specified for special critical applications. Alloy steels generally require additional care throughout their manufacture, since they are more sensitive to thermal and mechanical operations.

Stainless Steels: Stainless steels are high-alloy steels and have superior corrosion resistance to the carbon and conventional low-alloy steels because they contain relatively large amounts of chromium. Although other elements may also increase corrosion resistance, their usefulness in this respect is limited.

Stainless steels generally contain at least 10 per cent chromium, with or without other elements. It has been customary in the United States, however, to include in the stainless steel classification those steels that contain as little as 4 per cent chromium. Together, these steels form a family known as the stainless and heat-resisting steels, some of which possess very high strength and oxidation resistance. Few, however, contain more than 30 per cent chromium or less than 50 per cent iron.

In the broadest sense, the standard stainless steels can be divided into three groups based on their structures: austenitic, ferritic, and martensitic. In each of the three groups there is one composition that represents the basic, general-purpose alloy. All other compositions are derived from the basic alloy, with specific variations in composition being made to obtain very specific properties.

The *austenitic grades* are nonmagnetic in the annealed condition, although some may become slightly magnetic after cold working. They can be hardened only by cold working, and not by heat treatment, and combine outstanding corrosion and heat resistance with good mechanical properties over a wide temperature range. The austenitic grades are further classified into two subgroups: the chromium-nickel types and the less frequently used chromium-manganese-low-nickel types. The basic composition in the chromium-nickel group is widely known as 18-8 (Cr-Ni) and is the general-purpose austenitic grade. This grade is the basis for over 20 modifications which can be characterized as follows: the chromium-nickel ratio has been modified to change the forming characteristics; the carbon content has been decreased to prevent intergranular corrosion; the elements niobium or titanium have been added to stabilize the structure; or molybdenum has been added or the chromium and nickel contents have been increased to improve corrosion or oxidation resistance.

The standard *ferritic grades* are always magnetic and contain chromium but no nickel. They can be hardened to some extent by cold working, but not by heat treatment, and they combine corrosion and heat resistance with moderate mechanical properties and decorative appeal. The ferritic grades generally are restricted to a narrower range of corrosive conditions than the austenitic grades. The basic ferritic grade contains 17 per cent chromium. In this series there are free machining modifications and grades with increased chromium content to improve scaling resistance. Also in this ferritic group is a 12 per cent chromium steel (the basic composition of the martensitic group) with other elements, such as aluminum or titanium, added to prevent hardening.